Itron

Electric / Gas / Water
Information collection, analysis and application

California Energy Commission
Docket Office, MS-4
Re: Docket No. 12-IEP-1D
1516 Ninth Street
Sacramento, CA 95814-5512
docket@energy.state.ca.us
bneff@energy.ca.gov

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Re: Itron, Inc. ("Itron") Comments Regarding the Lead Commissioner Workshop on Combined Heat & Power in California

To Whom It May Concern:

On February 16, 2012, the California Energy Commission ("Energy Commission") held a Lead Commissioner Workshop on Combined Heat & Power in California in connection with the February 2012 report titled "Combined Heat and Power: Policy Analysis and 2011 – 2030 Market Assessment". Itron appreciates the opportunity to comment on the workshop and report.

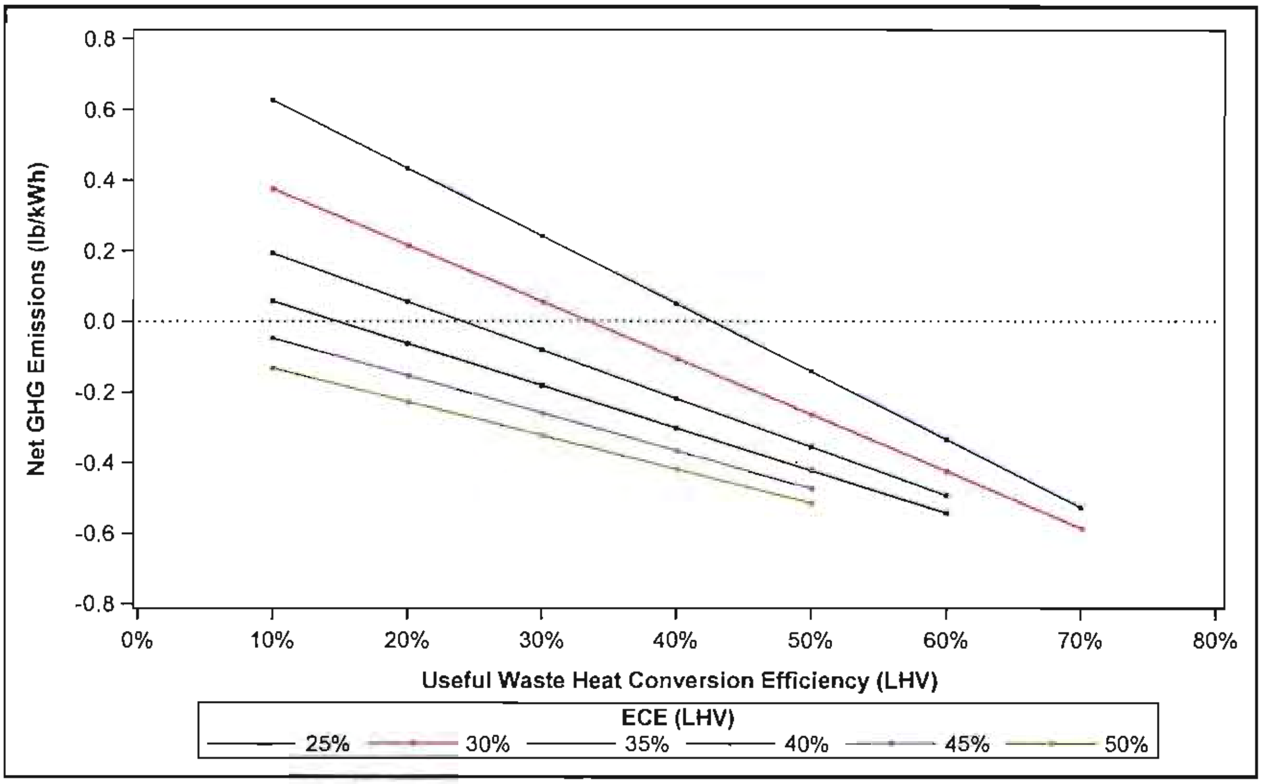
Importance of actual achievement of thermal utilization plans

In its February 2012 market assessment report ICF assessed the greenhouse gas ("GHG") emission reduction potential of a portfolio of prime mover technologies. For modeling purposes a thermal utilization rate of between 80 and 100 percent was assumed depending on market size. The resulting total potential for GHG emission reductions was substantial (from 1.4 to 1.5 million metric tons per year in 2020). Based on its experience as the impacts evaluation contractor for the California Public Utility Commission's ("CPUC") Self-Generation Incentive Program ("SGIP"), Itron would like to share some of its knowledge of the actual performance of SGIP CHP systems and how that relates to GHG emissions.

The nomograph presented in Figure 1 summarizes relationships among several factors: prime mover electrical conversion efficiency, useful waste heat recovery efficiency, and GHG emissions impact for CHP systems. If a CHP system achieves a lower electrical efficiency, it needs to achieve a higher useful waste heat recovery to achieve net GHG emission reductions. Conversely, systems with high electrical efficiencies do not need to recover as much useful waste heat to achieve net GHG emission reductions.

The CHP system performance assumptions used in the ICF study would be located near the lower-right ends of the lines; these points lie in a region of GHG emissions reductions. A critical takeaway from this nomograph is that many possible operating points lie in the region of increasing GHG emissions. If actual useful waste heat recovery rates fall short of planned values then CHP systems can lead to GHG emissions increases instead of reductions. As evidenced in measured performance of CHP systems operating under the SGIP, CHP systems are not inherently configured or implemented in ways to ensure high useful waste heat recovery. While CHP offers great promise for GHG emissions reductions, all parties involved with its promotion and utilization must be aware of its distinctive risk profile among the multitude of possible approaches to achieving reduced GHG emissions.

Figure 1: GHG Nomograph Showing Effects of Electrical and Thermal Efficiencies

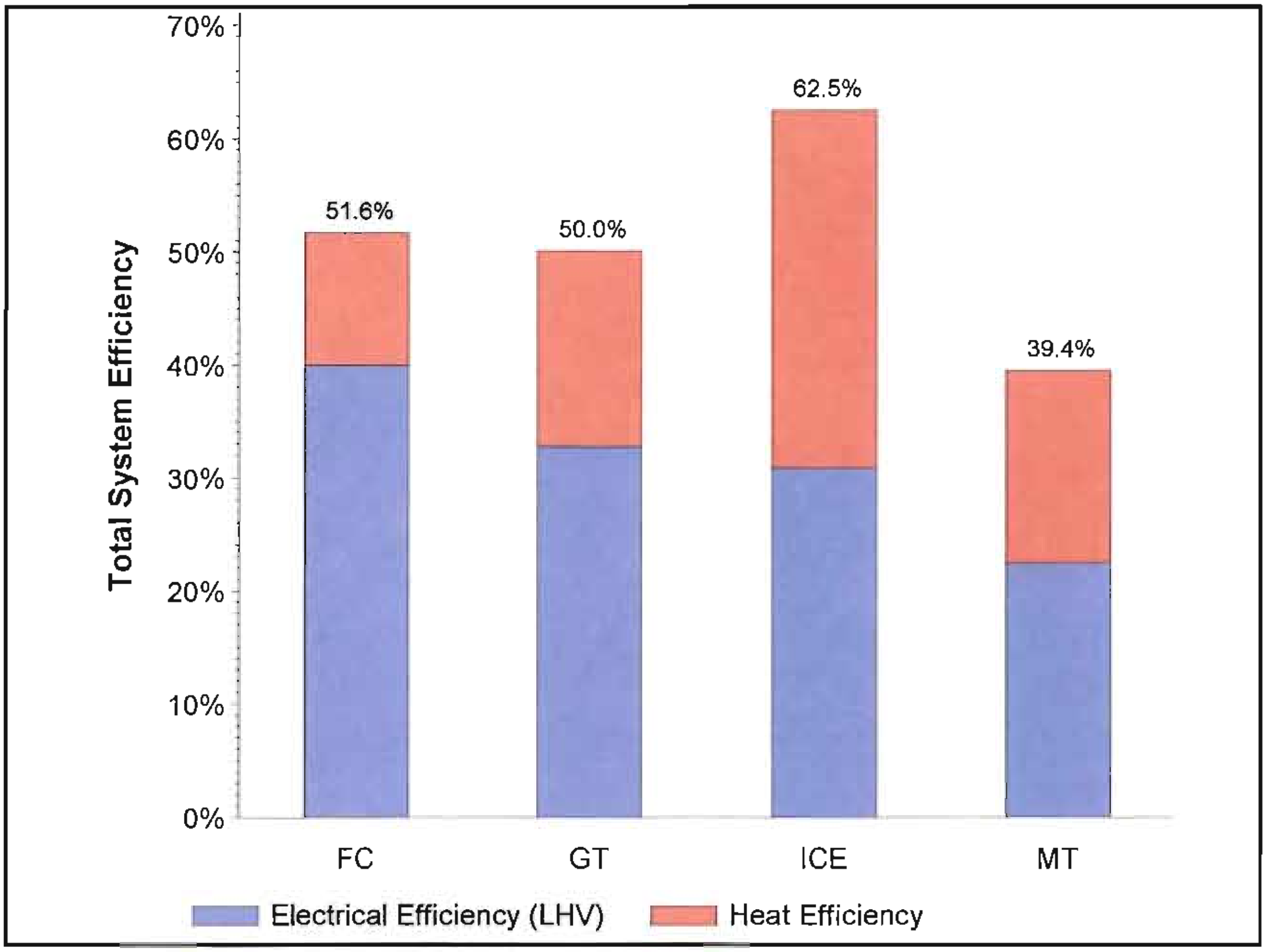


Increasing Useful Waste Heat Recovery

It is difficult for most distributed generation technologies to achieve the same electrical efficiency as off-peak grid power stations. From the perspective of GHG emissions reductions, the real benefit of CHP is in its ability to capture and utilize heat on-site. As shown in Figure 1, sufficiently high useful heat recovery rates can result in GHG reductions by offsetting natural gas combustion emissions from a boiler.

Useful waste heat recovery efficiencies from CHP systems may be far different than heat recovery estimates provided by manufacturer specifications. Manufacturer specifications refer to heat that could potentially be available for use. However, useful waste heat recovery is dependent not just on the amount of heat provided from the CHP system but also on the heat demand at the site. If the site heat demand is lower than the heat being provided by the CHP system, the heat is dumped to the environment with an associated reduction in the useful waste heat recovery efficiency. Figure 2 breaks down electrical and thermal efficiencies observed in non-renewable SGIP CHP systems operating in 2010. Observed heat recovery efficiencies are typically lower than expected based on manufacturer literature.

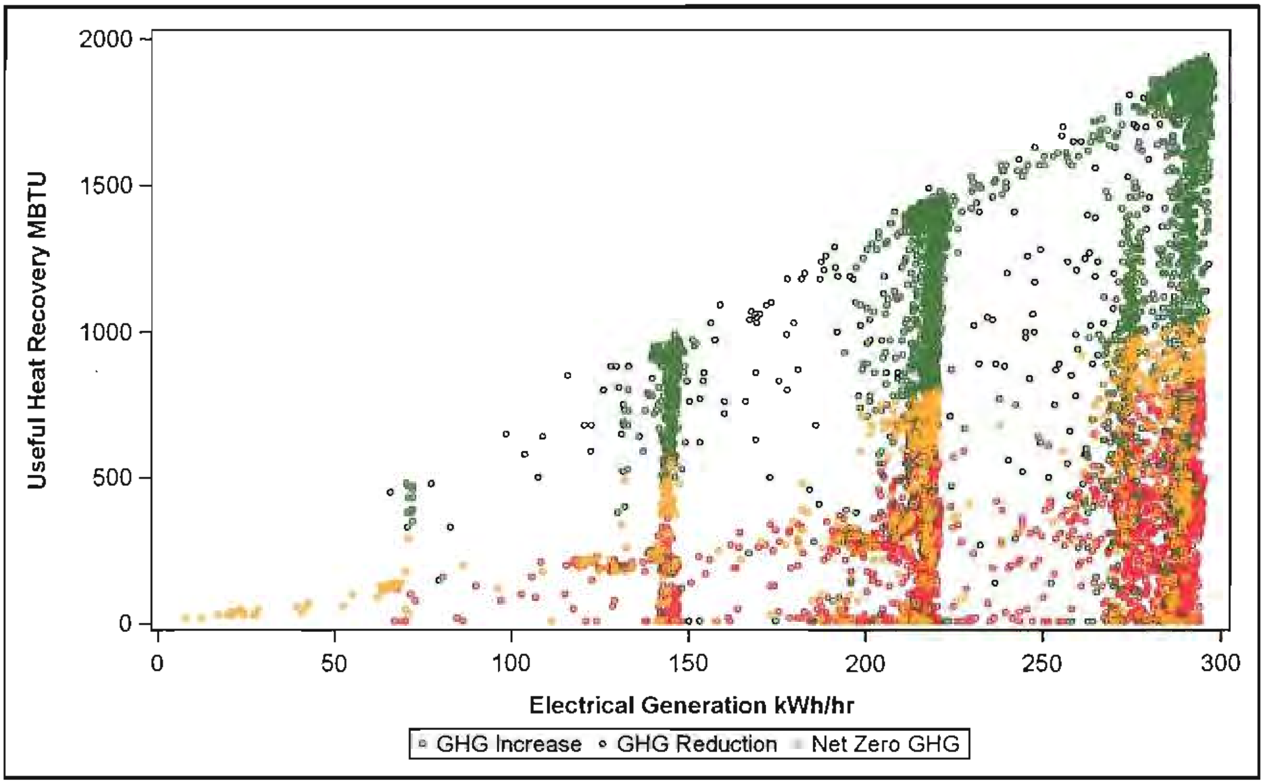
Figure 2: Total System Efficiency Components by CHP Technology (2010)



To understand why heat recovery rates are lower than expected, it is useful to drill down and examine site-specific CHP performance. Figure 3 illustrates the effects of useful heat recovery on GHG emissions. Using metered performance data from SGIP CHP systems, a net increase or decrease in GHG emissions is shown as a function of hourly electrical generation and useful heat recovery. Each point on the plot represents an actual hourly performance observation of a CHP system. The color represents the net effect on GHG emissions relative to a baseline where electricity is provided by the grid and heat is generated from a natural gas boiler.

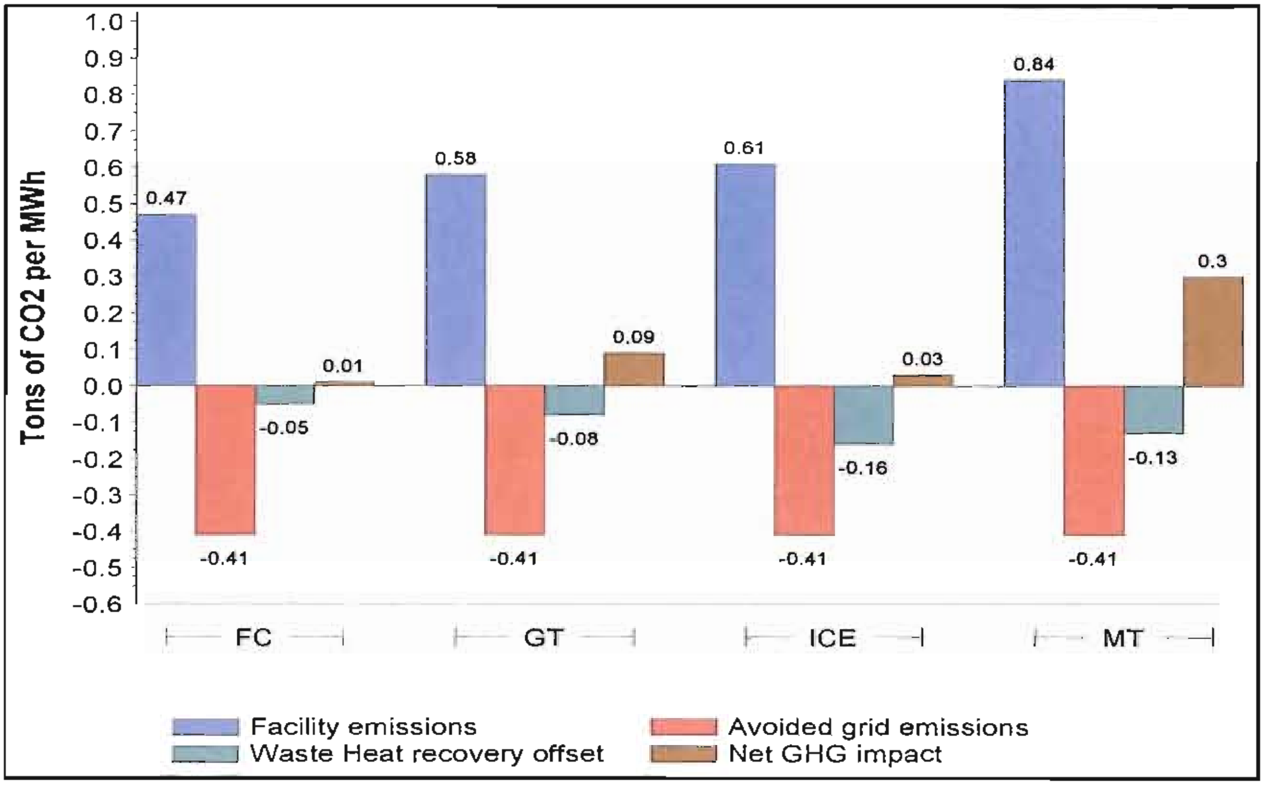
The vertical bands represent discrete operation of four 75 kW CHP units. In each operating condition, whenever heat recovery is high we observe a net reduction in GHG emissions (green). GHG emissions are increased (red) during periods of low heat recovery. The few instances of GHG reductions during periods of little or no heat recovery correspond to the less than 200 hours per year where the electrical efficiency of the CHP system is greater than the grid efficiency due to the operation of peaking plants.

Figure 3: Effect of Useful Heat Recovery on GHG Emissions



Low heat recovery effects clearly have an adverse effect on achievement of GHG emissions reduction goals. It can be seen in Figure 4 that in general, CO_2 emissions from non-renewable-fueled SGIP systems exceeded CO_2 emissions from the displaced grid-based electricity during 2010. Useful waste heat recovery operations act to reduce CO_2 emissions that would have resulted from use of on-site boilers. However, the magnitude of the reduced boiler CO_2 emissions was insufficient to enable non-renewable CHP systems to have net negative GHG emission values.

Figure 4: CO_2 Emissions from Non-Renewable CHP Projects in 2010



In its 2010 SGIP Impact Evaluation Report, Itron offered the following recommendations for ways that CHP systems can help achieve net GHG emission reductions:

1. Adopt targets set at achieving net GHG emissions at 10% below net zero levels for all CHP technologies. Because electrical conversion efficiencies for CHP systems are not expected to change significantly in the near term, the focus should be on setting useful waste heat recovery efficiencies that correspond to the desired net GHG emission target.
2. Coincidence of thermal and electrical loads is critical to ensuring that SGIP projects actually achieve net GHG emission reductions. Consequently, the CPUC and PAs should consider use of a combined capacity- based and performance-based incentive that focuses on thermal performance. This will enable the CPUC and PAs to provide rate payer monies only to projects that are achieving the desired goals.
3. The SGIP represents a significant investment of private and public monies. By focusing incentives on thermal performance, this may open the way for existing SGIP projects to repair or upgrade their existing waste heat recovery systems such that they achieve the necessary useful waste heat recovery efficiencies. This extends the number of projects that can receive SGIP incentive funds and increases the amount of net GHG emissions that can be achieved under the total amount of incentive monies. It will also help accelerate the rate at which the SGIP achieves net GHG emission reductions as

modifications to waste heat recovery systems can occur under a much shorter timeframe than development of a new project.

In their latest proposed revisions to the SGIP Program Handbook to implement decision (D.) 11-09-015, the SGIP PAs have recommended adoption of a "hybrid" performance based incentive (PBI) based on capacity factor and useful heat recovery. The PAs have also recommended changes to the screening requirements for program eligibility to enable more appropriate sizing of systems based on thermal demand. These changes will hopefully lead to higher heat recovery rates and corresponding progress toward CHP's potential for GHG emission reductions.

Bio-powered CHP

While bio-powered CHP was not included in the scope of the February 2012 Policy Analysis and Market Assessment report, Itron would like to share its experience in this area because it may be receiving further attention in the next update of the Commission's Bioenergy Action Plan, and bio-powered CHP was included among the questions the IEPR Lead Commissioner requested that parties address. Through the end of 2011 a total of 95 DG projects fueled entirely with biogas or with a mixture of renewable and nonrenewable fuel had received financial support through the SGIP. Forty-eight of these projects included heat recovery.

Utilizing on-site biogas to generate electricity is a clear way to reduce greenhouse gas emissions. The equivalent tons of CO_2 emissions associated with SGIP's bio-powered systems for which flaring and venting baselines were assumed for 2010 are presented in Figure 5 and Figure 6. GHG emission impacts are depicted graphically as the difference between SGIP emissions and the total baseline emissions. Total baseline emissions exceed SGIP emissions in these two cases; hence a reduction in GHG emissions is attributed to participation in the SGIP.

The baseline assumption (i.e., flaring versus venting) made for biogas used in SGIP is the factor exerting the greatest influence over estimates of GHG impacts. Biogas projects for which a venting baseline is assumed achieve significantly greater GHG reductions than those for which a flaring baseline is assumed.

Figure 5: Equivalent Tons of CO_2 Emissions - Flaring Baseline

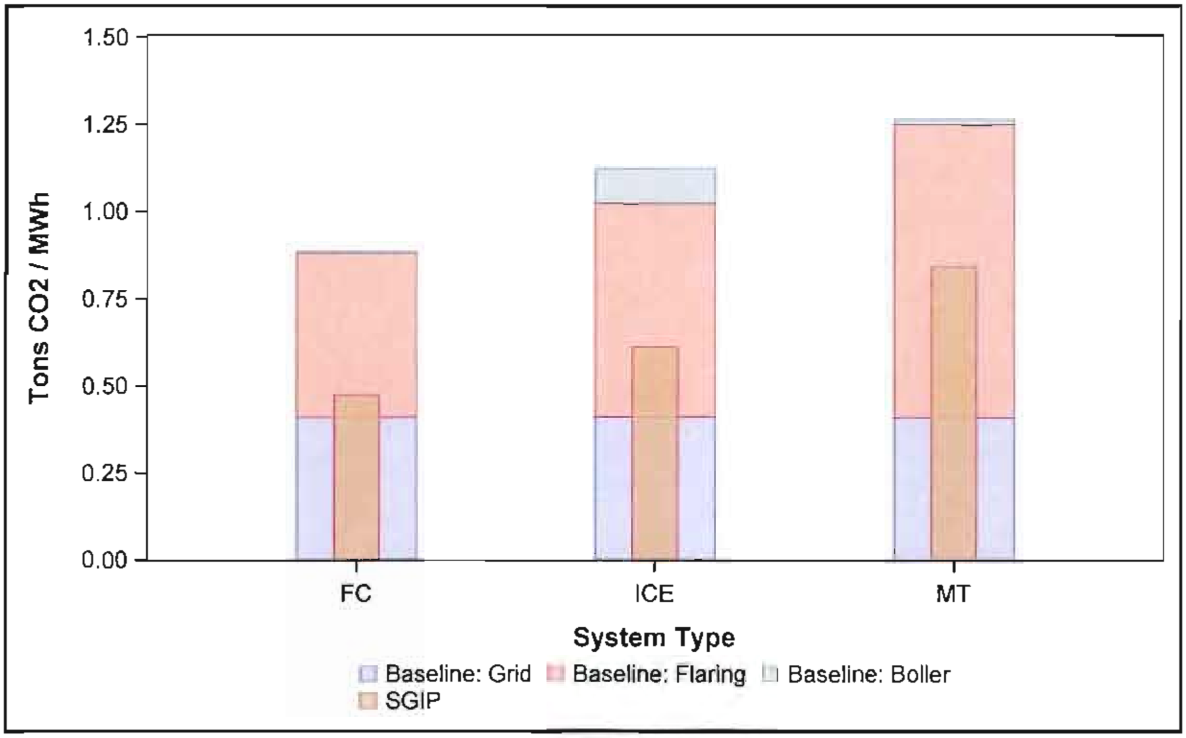
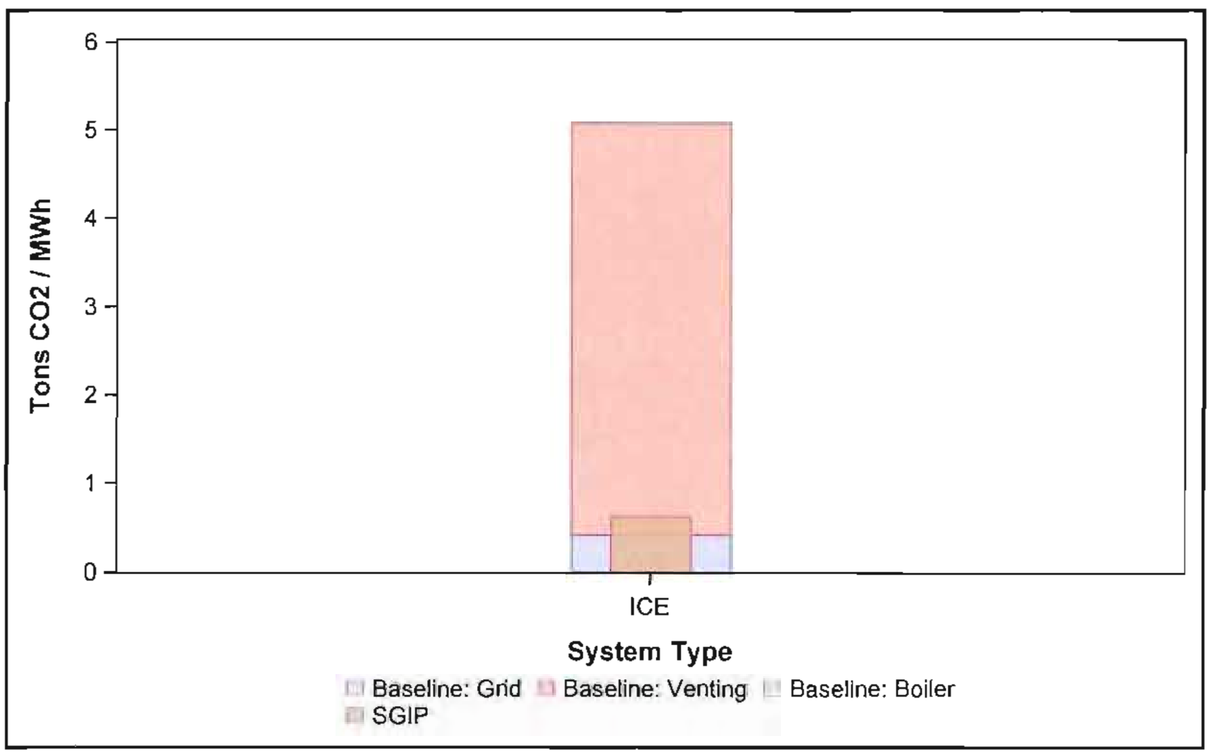


Figure 6: Equivalent Tons of CO2 Emissions - Venting Baseline



As noted above, a portion of systems contributing to the above results included heat recovery. If all of the systems had included heat recovery, GHG emissions reductions would have been larger. However, not all facilities fortunate enough to have a biogas supply also have a suitable heating or cooling load that could be served by recovered heat. This does not diminish the fact that bio-powered DG without heat recovery offers the potential for substantial GHG emissions reductions.

California has significant biogas resources that could potentially be used to generate renewable power and reduce GHG emissions. For example, there are over 1,000 landfills, 200 wastewater treatment facilities and thousands of dairies in the state that do not capture and use biogas generated by their operations. Locating bio-powered systems at these facilities could provide significant GHG emission reductions; help address regional ground water quality issues; serve as new renewable energy generating capacity; and create local jobs and employment.

In the final decision on implementing the SGIP in accordance with SB 412 requirements, the CPUC noted that "using renewable biogas and developing California's biogas industry remain important objectives as California transitions to a low carbon future."[1] Consistent with this decision, Itron recommended that the CPUC consider ways to significantly increase deployment of bio-powered facilities under the SGIP to help capture these potential benefits. Among the ways in which the CPUC could help facilitate increased deployment of bio-powered facilities is addressing the following issues:

- Updating the technical and economic potential for bio-powered projects in California, identified by source of the biogas (e.g., landfills, wastewater treatment plants, dairies, etc.), prime mover technology (e.g., IC engines, fuel cells, microturbines, etc.) and location.
- Identifying the primary barriers preventing further application and deployment of biogas-to-energy projects in California.
- Identifying and implementing actions that could be reasonably be taken by the SGIP PAs or the CPUC to help mitigate the barriers and help increase bio-power application and deployment under the SGIP.
- Updating the estimated GHG emission reductions associated with successfully deploying increased levels of bio-powered facilities and achieving the economic potential.

The existing SGIP and potential for dairy and landfill gas bio-powered systems are shown in Figure 7 and

[1] California Public Utilities Commission, "Decision Modifying the Self-Generation Incentive Program and Implementing Senate Bill 412," September 8, 2011, page 22.

Figure **8** respectively.

Figure 7: Existing SGIP and Potential Capacity for Dairy Biogas DG

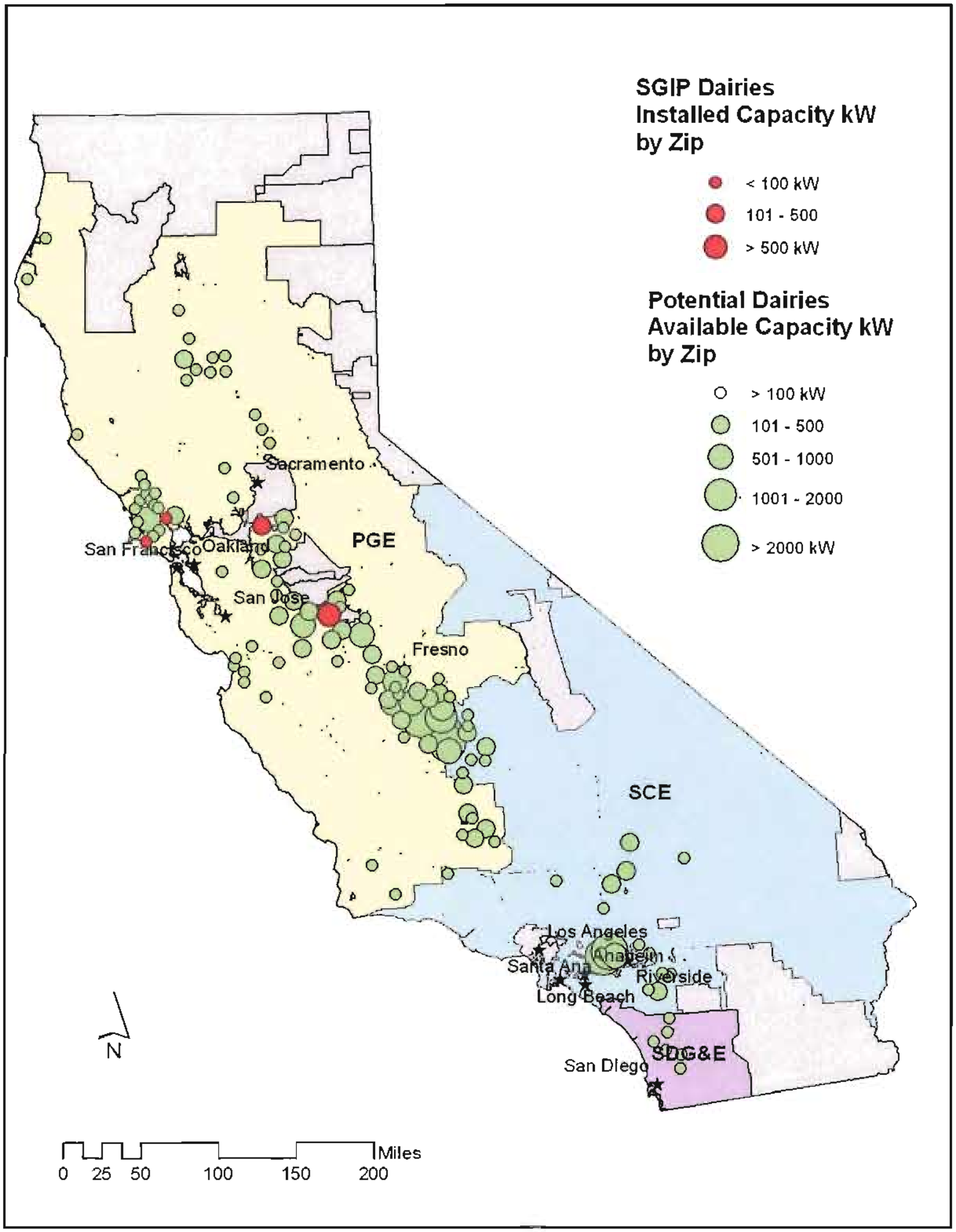
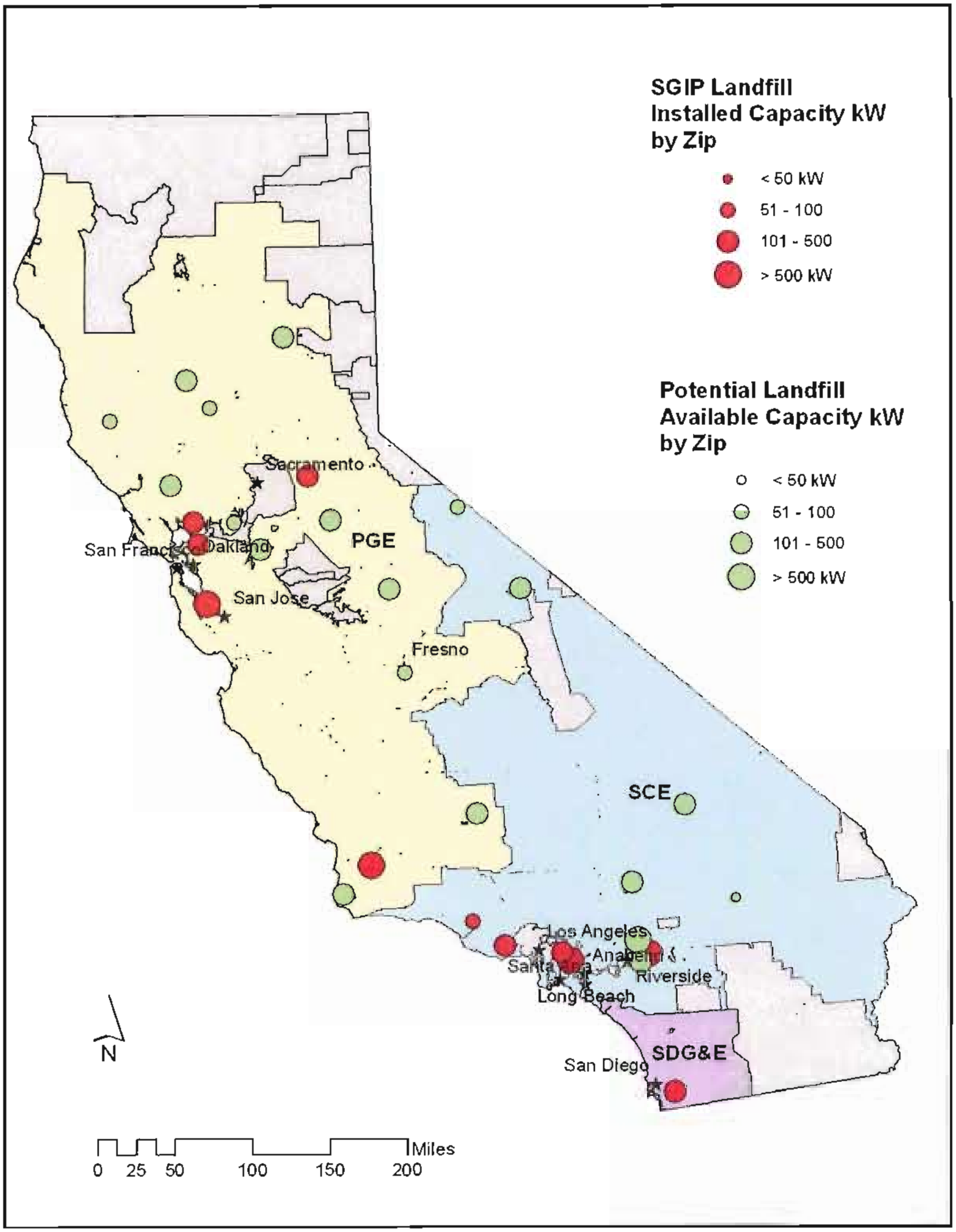


Figure 8: Existing SGIP and Potential Capacity for Landfill Gas DG



In summary, Itron believes that CHP offers significant opportunity for reduction of GHG emissions, that capturing these GHG emission reductions requires deliberate attention to achieving high levels of useful waste heat recovery and that bio-powered CHP systems provide unique and enhanced abilities to achieve significant GHG emission reductions.

If you have any questions or need additional information about these written comments, please contact George Simons at (509) 891-3180.

Sincerely,

George Simons

George Simons
Director, Consulting and Analysis
Itron, Inc.
2800 Fifth Street, Suite 110
Davis, CA 95618